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Title: Revolving Slide

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## REVOLVING SLIDE

### CROSS-REFERENCE TO RELATED APPLICATIONS

The present application claims the benefit of pending and commonly assigned provisional patent applications, as follows: U.S. Provisional Patent

10 Application Serial No. 60/454,273, filed March 14 2004 and entitled "Revolving Slide;" The entire contents of the foregoing provisional patent application is hereby incorporated by reference.

### BACKGROUND OF THE DISCLOSURE

#### 1. Technical Field

15 The present disclosure relates to enhanced slide, and more particularly to a slide system that facilitates efficient storage of, and access to, a variety of items and products. Exemplary systems according to the present disclosure include revolving slide(s) that permit reliable and efficient repositioning of one or more shelves, thereby enhancing utilization and efficiencies associated therewith.

#### 20 2. Background Art

Slides are widely used for displaying and storing items. Sometimes slides are contained within cabinets, armoires, closets, etc., and are constructed to facilitate access to items stored thereon. In designing storage, designers must ensure efficient access to stored items.

- 5           The height to which a stack of shelves can extend is typically limited by the reach of a person of average size. Alternatively, in some cases upper shelves are positioned out of the reach of users and various tools are provided to permit access to the contents of upper shelves. For example, users may be provided with tools that include footstools, stepladders, reach poles, etc. The use of such tools,
- 10           however, can be inefficient and, in some cases, can contribute to dangerous conditions. For example, people may be injured from falls off of stepladders and/or footstools. Likewise, the use of reach poles can result in inadvertent knocking and/or dislodging of the desired item or an adjacent item from the shelf. In such circumstances, item(s) may be broken or, worse yet, item(s) may fall from the
- 15           upper shelf, potentially striking and injuring the person using the reach pole or another person in the vicinity thereof. In addition, such tools are typically a nuisance to have about, can lead to injuries merely by tripping a person, and are frequently misplaced or not readily available for use.

- In the past, efforts have been directed to providing moveable shelves to
- 20           address the problems associated with fixedly positioned shelves. Examples of previous efforts directed to developing enhanced shelving systems, which are disclosed in the patent literature include the following U.S. patents.

- Ochse, U.S. Pat. No. 1,940,877, discloses extension shelving for display cabinets wherein the shelving may be drawn out of the display cabinet by means of tracks and rollers, and the shelves may be tilted to assume a rearward ascending step-wise arrangement, the lower-most shelf extending forward of the cabinet and the upper shelves.
- Snyder, U.S. Pat. No. 3,640,389, discloses a display stand and expandable shelf for use thereon. The Snyder '389 system includes a base and a pair of upright shelf supports. The components of the system are slidably engageable with each other and conventional fastening means are not required for assembly. Additionally, the shelves include a portion (80) that can be extended vertically upward from the remainder of the shelf (70) to form a step, and other portion(s) (90 and 96) can be extended horizontally outward from the shelf to form a wider shelf (again having a step).
- Brauning, U.S. Pat. No. 4,056,196, discloses a supporting framework for shelves including crosspieces interconnected with uprights. The cross pieces can ride up and down the uprights and, when positioned in a desired location, can be locked into place by a locking mechanism.
- Wyckoff, U.S. Pat. No. 4,651,652, discloses a vertically adjustable work desk that is raised by a force applied by a lockable gas spring via a first pulley system. A second pulley system insures that all areas of the work surface are equally raised.

- Duff et al., U.S. Pat. No. 4,919,282, discloses movable gondola shelving for merchandise display having a rolling base that supports channeled uprights and a center panel. Cantilevered shelves are interconnected with the channeled uprights by means of cam assemblies at the rear corners of the shelves. The cam assemblies allow for the shelves to be vertically adjusted while the shelves are maintained in a level position.
- Bustos, U.S. Pat. No. 5,014,862, discloses an assembly for a cantilevered display header for a gondola display rack that includes two uprights braced to the gondola display rack in vertical spaced relation. The header, which defines a light box that can receive a sign for illumination thereof, is mounted separately from the shelf and is vertically moveable with respect thereto for adjusting the height of the header with respect to the shelf.
- Duane, U.S. Patent No. 5,950,846, discloses a storage rack that includes vertically and horizontally moveable supports. The storage rack includes plural spaced horizontal supports for vertical motion. Vertical movement of the rack is powered by one or more hydraulic cylinders carried in the vertical support columns, and an associated control mechanism that allows adjustable vertical positioning of the rack. Horizontal supports of a compound nature are disclosed which permit lateral extension to expose material carried on the support element.
- Hardy, U.S. Patent No. 5,970,887, discloses an extendable shelf assembly that includes extender bars having slots and a cooperating pair

of rotatable sprockets that are affixed to an axle. The sprockets include a plurality of teeth that engage the slots of the extender bars.

- Anderson et al., U.S. Patent No. 6,065,821, discloses a vertically adjustable shelf and support rail arrangement for use in a cabinet. The shelf arrangement includes a pair of rotatably mounted rear sprocket members and a driving mechanism for rotating the sprockets to vertically adjust the shelf within the cabinet. The driving mechanism can be manually or electrically powered, and the adjustable shelf may include elements that ensure that the sprockets are not disengaged from the rails while the shelf is within the cabinet.
- Rindoks et al., U.S. Patent No. 6,112,913, discloses a support arrangement for a furniture system that includes a support assembly having a pair of standards which extend vertically in spaced relation. Each of the standards includes two rows of openings extending vertically in spaced relation. A first support member may be detachably mounted in a pair of outermost rows of openings, and a second support may be detachably mounted in a pair of innermost rows of openings.
- Santiago, U.S. Patent No. 6,164,610, discloses a cantilever shelf support system wherein the disclosed bracket includes a plurality of forwardly projecting cantilevered male members for insertion into mating female apertures formed in the shelf.

In addition to the prior art efforts discussed above, the present inventor has previously disclosed advantageous shelving systems. In particular, U.S. Patent No.

5,799,588 to Engel discloses advantageous shelving systems wherein shelves are provided in a stack arrangement mounted to two or more uprights. The uprights include one or more shelf support members, which support the shelves. One or more of the shelves are movable out from the shelf stack, either by way of a telescoping support member, or otherwise, to permit movement of such shelf or shelves to or past a lower shelf. After an upper shelf or shelves are moved vertically past a lower shelf, the upper shelf or shelves can be moved back into alignment with the lower shelf. In this arrangement, the upper shelf or shelves may be positioned below the lower shelf to permit easy access to the upper shelf or shelves (and their contents). Also, the present inventor has previously disclosed advantageous shelving systems. In particular, United States Patent Application 20030189021 to Engel discloses advantageous shelving systems wherein shelves are provided in a stack arrangement mounted to two or more uprights. Upper shelf or shelves are repeatedly moved vertically past a lower shelf and back into alignment with the lower shelf such as that the shelves moved horizontally and vertically in a revolving manner.

Despite these prior art efforts, a need remains for enhanced shelving system designs that allow its upper storage area to trade place with its lower area in a revolving manner to facilitate access to items stored thereon, while securing the shelves in a rest position when not used. These and other objectives are satisfied by the revolving slide and the enhanced shelving systems disclosed herein, as will be apparent from the detailed description, which follows.

#### SUMMARY OF THE DISCLOSURE

These and other objects are achieved by the revolving slide of the present invention, which includes one or more horizontal rollers e.g. horizontal slides in a stack arrangement mounted to one or more vertical rollers e.g. vertical slides. The vertical slides are themselves mounted to a support rail structure or arrangement.

- 5 The horizontal slides include one or more shelf support members, which support and secure the shelves to the vertical slides the shelves. One or more of the shelves are movable out from the uprights, by way of the vertical slides, or otherwise, to permit movement of such shelf or shelves to or past a lower shelf. The horizontal slides within a stack of slides are connected such that outward movement of one
- 10 horizontal slide effects a corresponding movement of the other horizontal slide. After an upper shelf or shelves are moved vertically to or past a lower shelf by means of the vertical slides, the upper shelf or shelves may be moved back into alignment with the lower shelf by means of the horizontal slides. In this arrangement, the upper shelf or shelves can thereby become positioned below the
- 15 lower shelf. This permits easy access to the upper shelf or shelves.

- In preferred embodiments of the present disclosure, a shelf/shelving unit that is moved to a “higher” or “upper” position, as described above, may be slide horizontally outward and moved past the “lower” shelves to again reverse position. In other words, the shelves/shelving units in the upper position may be repeatedly
- 20 moved past the shelves/shelving units in the lower position.

Vertical movement of the upper shelves and the lower shelf can be facilitated through a pulley arrangement whereby the upper shelf and the lower shelf are interconnected and constrained to move together in opposite directions.

Alternative structures and/or mechanisms may be used to effect shelf movement, e.g., motorized mechanisms and/or bar systems. Also, wheels, sprockets wheels, ball-bearing system, and such may facilitate the movement of the vertical slide.

5 The rails support guides the movement of the horizontal slides out and down, to a lower position, such as that upper shelf which mounted on the upper horizontal slides can be moved out and down to take the place of a lower shelf so that the upper shelf can be accessed.

According to the present invention, improved and advantageous slides and shelving system components are disclosed, including:

- 10 1. Revolving slide or a pair of revolving slide may be provided whereby repeated repositioning of shelves/shelving units is effected by outward horizontal motion of the shelf/shelving unit then located in the “upper” position. Thus, it is not always the same shelf/shelving unit that is moved outward to create the desired clearance, but rather the shelf/shelving unit  
15 located in the same relative vertical position that is moved outward to create such clearance. The same advantageous result may be achieved according to the present disclosure by repeatedly manipulating the shelf/shelving unit located in the “lower” position, if desired. Advantageous mechanisms and structural arrangements facilitating such relative motion of the  
20 shelves/shelving units are disclosed herein.
2. Advantageous ceiling height revolving slides are disclosed that allow a stack of shelves to trade places with another stack of shelves, and further



permit, within each shelving stack, shelves may be repositioned with respect to other shelves within the stack.

3. Advantageous slides and shelving systems include various rail system arrangements, e.g., designs wherein different numbers and combinations of rails to permit vertical repositioning of the horizontal slides and the shelves/shelving units.
4. Advantageous shelving systems are provided transport storage area to the desired level, e.g., elbow or eye level. The process may be controlled manually or by motor, gear, etc.
5. Advantageous shelving systems are provided that include one or more “split shelf” that facilitate vertical repositioning of shelves/shelving units, e.g., in European cabinet designs where a bar or face board is typically centrally positioned in the cabinet opening.
6. Advantageous shelving systems are provided that facilitate safe usage of storage areas by children and/or handicapped people, including wheelchair bound people.

These and other structural aspects, features and functionalities of the advantageous shelving systems of the present disclosure will become more readily apparent to those having ordinary skill in the art from the following detailed description of exemplary embodiments taken in conjunction with the drawings appended hereto.

## BRIEF DESCRIPTION OF THE DRAWINGS

So that those having ordinary skill in the art to which the disclosed shelving systems appertain will more readily understand how to make and use the same, reference may be had to the appended drawings, wherein:

5           FIG. 1 is a perspective schematic view of the first exemplary revolving slide that includes support rail structure constructed by two vertical rails and five horizontal rails, and two vertical slides and two horizontal slides according to the present disclosure.

FIG. 2 is an exploded view of the first exemplary revolving slide of FIG. 1.

10           FIG. 3 is a perspective schematic view of the second exemplary revolving slide that includes support rail structure constructed by three vertical rails, and two vertical slides and two horizontal slides according to the present disclosure.

FIG. 3A is a perspective schematic view of a vertical sliding frame. As seen in FIG 3 as well as the other exemplary, the vertical sliding frame is mounted on a  
15 rail system.

FIG. 3B is a perspective schematic view of a horizontal sliding frame. As seen in FIG 3 as well as the other exemplary, the horizontal sliding frame is mounted on the vertical sliding frame.

FIG. 3C is a perspective schematic view of a two-dimensional sliding  
20 frame. As seen in FIG 3 as well as the other exemplary, the two-dimensional sliding system is mounted on the rail system.

FIG. 4 is an exploded view of the second exemplary revolving slide of FIG.  
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FIG. 5 is a perspective schematic view, partially cut-away, of the second exemplary revolving slide of FIG. 3, showing an outward movement of vertical slides relative to vertical rails.

5 FIG. 6 is a perspective schematic view, partially cut-away, of the second exemplary revolving slide of FIG. 3 showing downward movement of the fully extended horizontal slides.

FIG. 7 is a perspective schematic view, partially cut-away, of the second exemplary revolving slide of FIG. 3 showing inward movement of the horizontal slides relative to vertical rails.

10 FIG. 8 is a perspective schematic view, partially cut-away, of the second exemplary revolving slide of FIG. 3 showing upward movement of the closed horizontal slides such as a guiding wheel push open a resting element.

FIG. 9 is a perspective schematic view, of the second exemplary shelving system of FIG. 3 showing upward movement of the horizontal slides, such as the  
15 guiding wheel is secured within the horizontal rail.

FIG. 10 is a perspective schematic, partially cut-away, view of the third exemplary showing revolving shelving system that includes two upper shelves mounted on a right revolving slide and two lower shelves mounted on left revolving slide according to the present disclosure.

20 FIG. 11A is an exploded view of the left side of the revolving shelving system of FIG. 10.

FIG. 11B is an exploded view of the right side of the revolving shelving system of FIG. 10 including the pulley system.

FIG. 12 is a perspective schematic view, partially cut-away, of the third exemplary of FIG. 10, showing outward movement of a first set of shelves associated with the right revolving slide.

5 FIG. 13 is a perspective schematic view, partially cut-away, of the third exemplary shelving system of FIG. 10, showing downwards movement of upper shelves and upward movement of lower shelves, which associated with the left revolving slide, such as the guiding wheel associate with the left revolving slide push open a resting element associate with the left horizontal slide.

10 FIG. 14 is a perspective schematic view, partially cut-away, of the third exemplary shelving system of FIG. 10, showing downwards movement of upper shelves and upward movement of lower shelves, which associated with the left revolving slide, such as the guiding wheel associate with the left revolving slide secured within the horizontal rail associated with the left revolving slide.

15 FIG. 15 is a perspective schematic view, partially cut-away, of the third exemplary of FIG. 10, showing inward movement of a first set of shelves associated with the right revolving slide.

FIG. 16 is a perspective schematic view, partially cut-away, of the third exemplary of FIG. 10, showing outward movement of a first set of shelves associated with the left revolving slide.

20 FIG. 17 is a perspective schematic view, partially cut-away, of the third exemplary shelving system of FIG. 10, showing downwards movement of upper shelves and upward movement of lower shelves, which associated with the right

revolving slide, such as the guiding wheel associate with the right revolving slide push open a resting element associate with the right revolving slide.

FIG. 18 is a perspective schematic view, partially cut-away, of the third exemplary shelving system of FIG. 10, showing downwards movement of upper  
5 shelves and upward movement of lower shelves, which associated with the right revolving slide, such as the guiding wheel associate with the right revolving slide secured within the horizontal rail associated with the right revolving slide.

FIG. 19 is a perspective schematic view, partially cut-away, of the third exemplary of FIG. 10, showing inward movement of a second set of shelves  
10 associated with the left revolving slide.

FIG. 20 is a perspective schematic view of the forth exemplary revolving slide that includes support rail structure constructed by four vertical rails and five horizontal rails, and two vertical slides and two horizontal slides according to the present disclosure.

15 FIG. 21 is an exploded view of the forth-exemplary revolving slide of FIG. 20.

FIG. 22 is a perspective schematic, partially cut-away, view of the fifth exemplary showing shelving system that includes two lower shelves mounted on a right revolving slide, two lower shelves mounted on a left revolving slide, and two  
20 upper shelves mounted on an upright support according to the present disclosure.

FIG. 22A is an exploded view of the fifth exemplary revolving of FIG 22.

FIG. 23 is another perspective schematic view, partially cut-away, of the fifth exemplary of FIG. 22, showing the right and the left two-dimensional sliding

systems, the shelf support associated with the two-dimensional sliding systems, and the mid upright with the associated pulley system and shelf support.

#### DETAILED DESCRIPTION OF EXEMPLARY EMBODIMENT (S)

The present disclosure provides enhanced slides and storage systems and, more particularly, slides that facilitate efficient storage of, and access to, a variety of items and products. The disclosed slides permit reliable and efficient repositioning of one or more shelves relative to rails supports in a revolving manner, thereby enhancing utilization and efficiencies associated therewith. The disclosed slides offer a stable, flexible construction that enhances safety for system users and significant economic benefits through cost-effective use of storage space.

Importantly, the slides of the present disclosure are susceptible to wide ranging applications. For example, the disclosed slides be advantageously employed in free-standing shelving systems, e.g., shelving systems for use in commercial or domestic applications such as retail product displays, warehouse storage, electronic and telecommunication equipment storage, garage and attic storage, food storage, etc. Moreover, the disclosed slides may be advantageously employed within enclosures, e.g., within armoires, closets, storage bins, freezers, refrigerators, kitchen cabinetry and the like. In addition, the disclosed “shelves” may take a variety of forms without departing from the spirit and/or scope of the present disclosure. For example, the exemplary “shelves” disclosed herein may alternatively take the form of hanging rods, drawers, bins and the like.

Additionally, the disclosed slides systems may be manufactured and/or distributed as free-standing, independent units or as components for use in retrofitting existing

shelving unit(s) and/or shelving system(s). Thus, as used herein, the terms "shelf," "shelves," "shelving system" and "shelving systems" are intended to broadly encompass shelving/storage applications wherein storage is achieved through vertically spaced storage elements and wherein efficiencies and/or benefits may be achieved through vertical repositioning of such storage elements.

In describing individual structural components associated with exemplary according to the present disclosure, elements that are structurally identical across different exemplary may be identified with an identical number reference. In such circumstances, it is to be understood that the disclosed elements are structurally identical in the disclosed exemplary embodiment, and that the element may be thereafter generically referenced in the subsequent narrative using only the same numeric designation. For example, elements 107b associated with first exemplary and element 107b associated with the second exemplary are functionally and structurally identical and as such were designated with the same number reference.

With reference to the enclosed figures, which depict exemplary embodiments of revolving slide according to the present disclosure, reference is initially made to the exemplary revolving slide 100a that is schematically depicted in FIGS. 1-2. Revolving slide 100a includes rail arrangement constructed of two vertical rails 102a and 102b, and five horizontal rails 103a – 103e. Vertical rails and horizontal rails are typically of identical construction. Vertical rails 102a and 102b may include telescopic functionality so that the disclosed shelving system can be adjusted to different sizes, e.g., based on available storage space, etc. For purposes of exemplary 100, rails 102a, 102b, and 103a-103e have a cross-sectional

C-shape that is substantially uniform from end to end to define vertical slots 102c and 102d and horizontal slots 103f-103j thereof.

With further reference to FIG. 2, the vertical rails and the horizontal rails form a rectangular support rail with passages or opening 112e, 112f, 112g, 112h.

- 5 The rails include mounting holes. Thus, support rail 101 may advantageously mounted to surrounding structure(s), e.g., walls, cabinetry, adjacent shelving supports, etc. However, alternative cross-sectional configurations are contemplated, e.g., cross-sections that are, in whole or in part, elliptical, trapezoidal, etc., as may be desired to achieve aesthetic effects and/or to
- 10 accommodate external considerations, e.g., space constraints or manufacturing and an engineering efficiencies.

With reference to FIG. 2, vertical slots are sized and dimensioned to accommodate vertical movement of the vertical slides or rollers 104a and 104b. The rollers typically include wheels arrangements 110a, 110b, 110c, and 110d.

- 15 Other means such as ball bearing systems or a sprocket wheels and matting slots along the legs of rails may be used to facilitate the vertical movements thereof.

- With further reference to FIG. 2, of note, it is contemplated according to the present disclosure that the vertical slides may be partially or fully mounted externally on the vertical rails 102a, 102b, thereby obviating the need for slots
- 20 102d. In an externally mounted design according to the present disclosure, the vertical slides are adapted for vertical movement relative to the vertical rails, and motion of the vertical slides may be guided by rails or tracks formed in the outer walls of the vertical rails. Further structural details related to implementation of



externally mounted shelf support members would be apparent to persons skilled in the art from the detailed description contained herein.

With further reference to FIG. 2, beams 105a and 105b attached to vertical slides 104a and 104b to synchronize the movement of the vertical slides such as  
5 movement of one vertical slide will trigger an equal movement of the other vertical slide. As seen in FIG 3A, as a unit, vertical slides 104a and 104b and horizontal beams 105a and 105b define a rectangular or square sliding frame 104 that enjoys enhanced structural stability.

With further reference to FIG. 2, horizontal slides 106a and 106b (which  
10 may be fabricated, at least in part, utilizing a conventional drawer slide) are mounted on beams 105a and 105b respectively. Vertical beams 107a and 107b attached to the horizontal slides 106a and 106b to synchronize the movement of the horizontal slides, such as movement of one horizontal slide will trigger an equal movement of the other horizontal slide. As seen in FIG 3B, as a unit, horizontal  
15 slides 106a and 106b, and vertical beams 107a and 107b define a horizontal sliding frame 106. Also, as seen in FIG 3C, as a unit, vertical slides 104a and 104b, horizontal beams 105a and 105b, horizontal slides 106a and 106b, and vertical beams 107a and 107b define a two-dimensional sliding system 108.

With further reference to FIG. 2 a wheel or roller 109 is rotatably mounted  
20 to upstanding element 107b and is adapted to ride on a flap 111a cooperative structure formed inside vertical rails 102b and horizontal rails 103g. Flap 111a, which is the bottom leg of rail 103g or a stand-alone element supported by rail

103g and extended inside rail 102b, is operable like a door and can be open upward.

With further reference to FIG. 2 a pulley wheel 108a mounted with respect to vertical rails 102b.

5           With reference to the enclosed FIGS. 3-4, which depict exemplary embodiments of revolving slide 100b according to the present disclosure, revolving slide 100b is similar in all aspects to revolving slide 100a but for the addition of vertical rail 102c as seen in FIG 3 and the opening 112e and 112f as depicted in FIG 4. The purpose of adding a vertical rail is to provide an exclusive leading rail  
10 to the leading wheel or to provide an integral room for installing damper or any element, which may facilitate the operation of the revolving slide.

With farther reference to the exemplary 2, FIGS. 5-9 (which some of their elements were removed for clarity) illustrate the revolving functionality associated with revolving slide 100b. Turning to FIG.3 the two-dimensional sliding frame  
15 108 is initially positioned in an upper position. Leading wheel 109, which is attached to the horizontal sliding frame 106 and rest on flap 111a, secures the two-dimensional sliding frame 108 in an upper position. As seen in FIG 5, the leading wheel can be seen, as the top of beam 107b is partially removed. Farther to FIG 5, the horizontal sliding frame 106 is fully pulled forward. This outward position was  
20 accomplished since the leading wheel 109, which is associated with horizontal sliding frame 106, traveled horizontally along a flap 111a and through opening 112c, 112a, and 112e and into vertical rail 102c. As seen in FIG 6, the two-dimensional sliding system 108 is in a full lower position. This lower position was

accomplished since the leading wheel 109, which supports the two-dimensional sliding system 108, was capable of traveling vertically along vertical rail 102c. As seen in FIG 7, the horizontal sliding frame 106 is fully pushed inward. This inward position was accomplished since the leading wheel 109, which is currently aligned with horizontal rails 103i, traveled horizontally along horizontal rail 103i and through opening 112f, 112b, and 112d and into vertical rail 102b. As seen in FIG 8, the two-dimensional sliding system 108 is in an upward position where leading wheel 109 opening a passage by pushing flap 111a upward. This upper position was accomplished since the leading wheel 109, which supports the two-dimensional sliding system 108, was capable of traveling vertically along vertical rail 102b. Turning to FIG 9, the two-dimensional sliding system 108 is in a fully upward position where leading wheel 109 rests on flap 111a and securely aligned with horizontal rail 103g. This secured upper position was accomplished since the flap 111a return to its original position allowing the wheel to rest on it. At this position, the two-dimensional sliding system 108 accomplish a full revolving motion and ready for more revolving motions.

The enclosed FIGS. 10-19 depict exemplary embodiments of revolving storage system 100c. As seen in FIG 110, FIG 11A, and FIG 11B, revolving storage system 100c is assembled from right revolving slide 201, left revolving slide 202, shelves support 301 and 302, pulley system 400, first shelves 501, 502, and second shelves 503, 504. With farther reference to FIG 10, FIG 11A, and FIG 11B the left revolving slide is similar in all aspects to the left revolving slide. Both revolving slides, the left and the right, are also similar in any aspect and

operation to the revolving slide shown in FIG 3 – FIG 9. Also as seen in FIG 11B pulley system 400 include right pulley wheel 108a, left pulley wheel 108b, elongated rod 403, which synchronize the rotation of pulley wheel 108a and pulley wheel 108b, first pulley cable 401 mounted rearwardly and around pulley wheel 108a , and second pulley cable 402 mounted forwardly and around pulley wheel 108b. As seen in FIG 13, pulley cable 401 is also attached to two-dimensional sliding system 108, and pulley cable 401 is also attached to two-dimensional sliding system 208.


With farther reference to the exemplary 3, FIGS. 12-19 illustrate the revolving functionality of revolving shelving system 100c. The revolving motion of shelving system 100c is accomplished by two opposite revolving slides, which coact through pulley system 400. As seen in FIG 12, first shelves 501-502, which are mounted on the right revolving slide and in an upper position, slide outward in the same manner as explained with reference to FIG 5. As seen in FIG 13 and FIG 14, first shelves 501, 502 slides downward in the same manner as explained with reference to FIG 6. As first shelves 501,502 move downward relative to the right revolving slide the pulley/cable systems automatically effect an opposite motion for the second shelves 503,504 associated with the left revolving slide. Thus, the second shelves move upward. As seen in FIG 13 wheel 209 associated with revolving slide 201 opened flap 211a as the second shelves move upward. As seen in FIG 14, once the first shelves is fully descending the second shelves is fully ascending. As seen in FIG 14, second shelves is secured in upper position as leading wheel 209, rests on flap 211b. With reference to FIG 14, once the first

shelves reach the lower position, they may be pushed horizontally inward into alignment with the second shelves as seen in FIG 15 and in the same manner as explained with reference to FIG 7. With reference to FIG 16, second shelves 503-504, which are mounted on the left revolving slide and in an upper position, slide outward in the same manner as explained with reference to FIG 5. As seen in FIG 17 and FIG 18, second shelves 503, 504 slides downward in the same manner as explained with reference to FIG 6. As second shelves 503, 504 move downward relative to the right revolving slide the pulley/cable systems automatically effect an opposite motion for the first shelves 501, 501 associated with the right revolving slide. Thus, the first shelves move upward. As seen in FIG 17 wheel 109 associated with revolving slide 101 flap 111a as the second shelves move upward. As seen in FIG 18 once the second shelves is fully descending and the first shelves is fully ascending. As seen in FIG 18, first shelves is secured in upper position as leading wheel 109 rests on flap 211a. With reference to FIG 18, once the second shelves reach the lower position, they may be pushed horizontally inward into alignment with the first shelves, as seen in FIG 19 and in the same manner as explained with reference to FIG 7.

With reference to the enclosed FIGS. 20-21, which depict exemplary embodiments of revolving slide 100d according to the present. Revolving slide 100d is similar in all aspects to revolving slide 100b but for the addition of vertical rail 102d and its associated flap 111b, the addition of the openings 112g and 112h, and the addition of pulley wheel 108b. The purpose of adding a vertical rail is to provide an additional leading rail to the leading wheel as depicted in exemplary

100e thereafter, or to provide an integral room for installing damper or any element, which may facilitate the operation of the revolving slide.

Turning to FIGS. 22-23, exemplary shelving system is disclosed, and is similar to a shelving system disclosed in United States Patent Application 5 20030189021, but the addition of pulley wheels 108b, vertical rail 102d, rail 101c, and flap 111b associated with revolving slide 108, and pulley wheels 208b, vertical rail 202d, vertical rail 20c, and flap 211b (not seen in the drawings) associated with revolving slide 208.

With further to FIG 22 and 22A, a central upright 303 supports shelf 10 support member 110. With particular reference to FIG. 22A, telescoping -shaped shelf support member 110 cooperates with an elongated slot formed in central upright support 303. First shelves 601, 602 are supported by shelf support member 110 and are adapted for horizontal and vertical motion relative to central upright support 303 based on the telescoping functionality associated therewith.

15 Two-dimensional sliding system 108, which is associated with revolving slide 103, includes shelf support 301 and support second shelves 603, 604. Two-dimensional sliding system 208, which is associated with revolving slide 203, include shelf support 302 and support third shelves 605, 606. Gaps are defined between second shelves and third shelves. The gaps are sized and configured to permit passage of

20 the outwardly extending telescopic arms of shelf support member 110 there through. Thus, the foregoing gaps permit vertical repositioning of shelf portions first shelves 601, 602 relative to second shelves 603, 604 and third shelves 604, 605.

Pulley/cable systems are provided to automatically translate motion between the respective shelves/shelf portions. Thus, as cables 401, 402 are drawn upward, i.e., wrapped around uptake pulley wheels 108b and 208b respectively, cable 404 is extended from central uptake wheel 108e (based on a reverse winding thereof). Conversely, cables 401, 402 are let out as cable 404 is drawn in. Synchronizing rod 403a and 403b coordinates the motions there between.

With reference to exemplary 100e and as disclosed in United States Patent Application 20030189021, one or more of the second or third shelves may advantageously include alignment pin(s) (not shown here) to align the opposed second shelves and third shelves. These alignment pins are pivotally mounted and are adapted to pivot upward and downward from the depicted horizontal orientation to a non-horizontal orientation to permit passage of outwardly extending elements of shelf support member 110 there through. Once the passage is complete, the pins, which are generally spring biased, resume their initial horizontal orientation.

The combination of pair of this exemplary revolving slides and central upright support, in exemplary shelving system 100e permits the revolving functionality.

In use, shelves 601 may be moved horizontally outward, as described above with reference to telescoping structures and sliding frames associated with other exemplary shelving systems of the present disclosure. Once fully pulled out, the vertical positioning of the first shelves and the second and the third may be reversed, with the pulley/cable systems automatically translating vertical motion therebetween. Moreover, exemplary shelving system 100e advantageously allow

the shelves to trade place in a revolving manner as vertical repositioning of the first and second shelves may be advantageously achieved by outward movement of the first shelves when they are in the upper position, and outward movement of the second shelves when they are in the upper position, rather than limiting the outward movement to either the first or the second shelves. Similarly, the horizontal motion may be limited to shelves that are in the “lower” position. Thus, exemplary shelving system 100e advantageously permits vertical repositioning of shelves/shelving units by way of a substantially clockwise or counter-clockwise movement of the first and second shelves.

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